Abstract

This case study represents the Diagnosing and Action Planning phases of a larger program of research directed at leveraging IT to improve operational and clinical efficiency. Applying a broad understanding of information systems (IS) to include technologies, processes, and people, the purpose of this study was twofold. First, we wanted to understand the existing portfolio of technologies in the broader context of the range of factors (e.g., technical, cognitive-emotional, logistical, and health system related) enabling and constraining the completion of scheduled appointments within a colon cancer screening centre (CCSC). Second, based upon this evidence we wanted to provide recommendations for targeted IT investments to improve colon cancer screening efficiency through a reduction in incomplete appointments. Our findings indicate the need for collaborative self-serve technologies in order to mitigate the key constraints (costs, fear, logistics, system etc.) while building upon those mechanisms and practices that work (phone reminders, concierge service etc.). We conclude with limitations of this study and plans for future research.

1. Introduction

Health care provides a complex institutional context consisting of a wide array of interdependent actors, in which there is widespread and ongoing reform and technology investment, making it an ideal context to investigate technology-enabled change. While technological innovation has improved productivity, efficiency and profitability for many organizations, the rapid evolution of medical technologies is a key cost driver in the Canadian health system where rising costs have lead many to question the sustainability of the system [1,2]. Leveraging technology in order to provide more and better care with the same resource inputs is vital.

Colorectal cancer (CRC) is an important public health problem. It is the most commonly diagnosed type of cancer in Alberta, Canada and the second leading cause of cancer-related death [4]. Current guidelines [5] recommend asymptomatic individuals over the age of 50 have a colonoscopy every ten years. Despite strong evidence that screening reduces CRC incidence and mortality, screening rates are low [6,7,8]. The Canadian Cancer Society reports that only 44% of those who should undergo screening have done so [9]. The CCSC opened in January 2008 with the goal of providing all screening-related colonoscopies in the Calgary area [10].

Failure to complete scheduled medical appointments erodes efficiency by underutilizing clinicians and equipment. Furthermore, when planned care is not delivered, health complications can occur, resulting in both increased costs and human suffering. In this latter case, undetected colon cancer results in more serious illness and greater treatment costs. Finally, frustrated patients and stressed staff are additional consequences of such inefficient operations.

The term “incomplete appointments” encompasses all scheduled appointments that are not completed for any reason, including appointments lost due to patient non-attendance, which has been studied extensively and will be reviewed in some detail in the next section.

2. Literature review

Colorectal cancer screening (CRCS) is an underutilized service [7] in Canada. Completion of recommended screening is important for population health, as well as system efficiency and effectiveness. Incomplete appointments are a common problem with more than a third of American family practices having a “no-show” rate greater than 21% [11]. In the area of colonoscopy, non-attendance is even more common. Based on the University of Pennsylvania Health System’s scheduling and billing records, Turner et al [12] found that 40% of patients did not attend their first scheduled appointment for colonoscopy. Other research suggests that, only about 50% both attended and completed the scheduled colonoscopy [13].
Three areas of research were reviewed. First, we introduce literature examining correlates of appointment completion for colorectal cancer screening. Second, we review research exploring the reasons behind incomplete colonoscopy appointments. Finally, we review literature assessing interventions designed to improve appointment completion.

Eleven studies were reviewed which examined a variety of factors associated with completion of colorectal cancer screening appointments with a consistent rate of incomplete appointments in the 40-50% range. None of the studies reviewed described a two-stage screening process like that employed at the CCSC and none were undertaken in the Canadian setting.

Longer waiting times predicted greater likelihood of non-attendance [14], as did younger age [15]. Improved attendance was associated with being referred by a specialist, [14,15], having a higher perceived risk of cancer [16], believing cancer was preventable [16], presenting with more risk factors and co morbidities, perceiving fewer barriers and being married [17].

Gender was not consistently associated with missed appointments. Three studies found males more likely to attend [16,18,12], two reported females more likely to attend [19,20] while six found no relationship [13-15,17,18, 21].

Although more attention has been given to patient demographics some research has explored the reasons for missed appointments. In a prospective study, Murdock et al [22] examined patient-related reasons for missed appointments at a gastroenterology clinic in the United Kingdom. Data was collected by mail and telephone questionnaire from patients who missed appointments on one of 27 non-consecutive clinic days. The overall average non-attendance rate of 14% was similar to the 12% national non-attendance rate. The most common reason for non-attendance was “forgot” (30%), followed by “no reason” (26%) and the catch all category of “miscellaneous” (20%). Murdock [22] surmised that the main reason for non-attendance was “apathy” and suggested that “no strategy to improve attendance is likely to have great impact” (p 284). Given the large portion of barriers attributed to “no reason” or “miscellaneous” it is apparent that the questionnaire did not provide enough depth to support a meaningful understanding of the reasons behind missed appointments.

The second category of literature primarily included qualitative studies completed in the United States, which used patient interviews and/or focus groups to explore the reasons behind incomplete colonoscopies. The majority of studies [23-26] took place in “safety net” settings, which serve low income patients - often members of minority groups (African-American, Latino etc.). Characteristics of primary care, knowledge, perceived risk, procedural issues, costs, fear and competing priorities were prevalent content areas identified in these studies.

Denberg [18] was the sole study obtained which involved a university-based clinic with an affluent patient population. This was the first study to employ mixed methods whereby quantitative analysis identified sex, age and insurance type as predictors of attendance behavior followed by qualitative interviews explored the reasons for non-adherence. Denberg [18] identified three major content areas: cognitive-emotional (fear, lack of perceived risk), logistic (cost, competing demands) and health system (scheduling challenges, long wait times).

The third domain of research considered included evaluating strategies attempting to improve appointment completion. Nash et al [27] described a three part program designed to decrease the “broken” appointment rate and increase the volume of colonoscopies completed in New York. At baseline, more than 50% of appointments were missed. The intervention involved patient navigators (staff to assist patients with paperwork and provide reminders), a streamlined Diagnostic Endoscopic Referral System (a streamlined referral process), and updated operational equipment. The broken appointment rate declined from 67% in May 2003 to 5% in June 2003. In a randomized controlled trial Ling [28] examined the impact of “enhanced office and patient management” on colon cancer screening. Enhanced service practices involved clinic processes and patient education. This intervention significantly improved adherence to colorectal screening with 1.63 folds increase in the odds of attendance (p=.01). Denberg et al [18] randomly mailed brochures to patients between referral and colonoscopy appointment. Adherence was 11.9% higher in those who received the information brochure compared to the controls suggesting education and reminders are important factors.

Turner [21] identified patients with a history of poor appointment attendance for appointments with their family physician and randomly assigned them to receive either a call from a “peer coach”, or a mailed brochure. The patients who received a peer coach had increased odds of attendance of 2.14 in this high risk group. Both education and social support appear to be important factors in adherence to colonoscopy with social support being the more effective of the two.

Lachter [29] examined the impact of public lectures on colon cancer screening in Israel using a pre-post questionnaire. Although response rates were low (16.7%) and evaluation was based on a questionnaire regarding intention to undergo screening rather than actual participation, the author concluded that public
lectures improve compliance and suggested that same-sex gastroenterologists should be available to further facilitate participation.

Adams retrospectively assessed the impact of telephone reminders on endoscopy attendance. The improvement observed was not statistically significant (p=0.03). A systematic review [30] reported that reminder calls were effective in increasing screening for numerous screens (mammography, pap, sigmoidoscopy) but did not review any studies specific to colonoscopy.

A recent systematic review [30] found that reminder calls were effective in increasing screening for numerous services (mammography, Pap, fecal occult blood tests and flexible sigmoidoscopy), but suggested that the impact on colonoscopy required further investigation.

Outside of the colon cancer screening arena, other strategies have been proven successful in improving attendance. In 2006 Milne et al [31] reported the impact of text messaging reminders and partial booking procedures on the attendance rates at a children’s hospital in the United Kingdom. Milne compared attendance rates before and after the implementation of partial booking practices (a method of booking whereby patient chooses appointment slot), among patients with and without text reminders. Reminder messaging reduced the no-shows by about one third in new appointments booked. Text messaging did improve attendance for the partial booking appointments, albeit to a lesser extent.

Finally, McCann [32] examined a genetics clinic in Wales that implemented “Patient Focused Booking”. When patients were given increased choice in scheduling their appointment, attendance improved. The efficiencies gained were so dramatic that the clinic was able to manage a 50% increase in referrals.

In the next section we describe a study that focused on incomplete pre-screen appointments as an index of efficiency and examined the information systems, including technologies and the processes, by which patients, front line staff and management were implicated in the failure to complete scheduled appointments.

3. Methodology

The research context is the Colon Cancer Screening Centre (CCSC) at the University of Calgary. The CCSC provides an ideal setting for this study since it is a relatively young organization (opening to patients in 2008), facilitating the ability to investigate, with some confidence, the historical events related to the creation and evolution of the centre. Access to the centre including key documents, data, staff and management was available for an extended period (~12 months).

The CCSC employs a two-step appointment process whereby patients undergo pre-screen consultations to provide education and to ensure they are medically fit to undergo colonoscopy in a clinical setting. After completing the pre-screen, patients who are medically suited, are invited to book a return visit for the colonoscopy. This study focuses on the pre-screen appointment which occurs earlier in the supply chain and was found to be have a larger portion of incomplete appointments (~21%) than the colonoscopy appointment (~5%).

We broadly draw upon Structuration Theory [33] as a sensitizing device viewed through the practice lens [34] to consider the interplay between the hands on use of various technologies (structuring) and the broader institutional context in which this use emerges (metastructuring). Specifically we use this framework to sensitizes this work to the role of activities that serve to enhance/impede the direct care of patients (e.g., structures that emerge through the direct use of improved technologies) but also the role of activities that are more indirectly implicated in that use (e.g., the meta-structures that emerge from the indirect factors such as those associated with incomplete appointments). For collaboration to be effective, there needs to be a level of consistency or alignment among all forces represented by the arrows in Figure 1 below.

Figure 1. (Meta)Structuring Processes [34]
Mixed methods were employed to elicit a comprehensive understanding of the underlying reasons for incomplete pre-screen appointments. A review of documents (contracts, organizational charts, policies, procedures, manuals, etc.) provided context and informed understanding of the conceptualization and formation of the CCSC. Observation and interaction with staff and patients provided first-hand knowledge of current and evolving operational processes including booking practices, patient and information flows, and the common challenges of completing scheduled pre-screen appointments. Figure 2 outlines data collection activities.

Figure 2. Data Collection Timelines

Interviews included a comprehensive range of participants involved in pre-screen appointment scheduling (clerical staff, clinic management) as well as a variety of patient types in order to discover the factors that support and impede pre-screen appointment completion. Individuals who did not speak English were excluded from interviews. Each interview was recorded and professionally transcribed verbatim resulting in 47 and 30 pages of text for the staff and patient interviews respectively. See Table 1 for a summary of participants.

This triangulated approach provided credible representations of the factors influencing pre-screen appointment completion. Sound strategies to improve pre-screen appointment completion rates were identified. Furthermore, the barriers and enablers identified at this “micro” level of operations are proposed to be both contributing to and resulting from the efficiency of the CCSC and, in turn, the health system overall.

4.0 Findings – Incomplete Appointment Patterns

The original vision of the CCSC included open access to service whereby referrals could be made by a physician, other health care provider, or even by an individual patient. Various methods of referrals were envisioned (fax, mail, phone, web-based); in reality, only faxed physician referrals were used in practice. Initial plans suggested appointments would be booked over the phone and confirmed 3 days prior to the booking by phone or by e-mail. Only Urgent Priority patients (~12% of the referrals) were contacted by phone for booking. The remaining patients received letters notifying them of the pre-screen appointment.

The vision for the CCSC was one of a paperless clinic, leveraging technology to improve efficiency and quality of care. In reality the CCSC used both electronic and paper files resulting in redundancy in creating these records and significant time spent looking for misplaced files. Figure 3 contrasts processes observed in practice with the visions of the CCSC discovered during documentary review.
In the early days of the CCSC, patients were contacted by phone and reminder calls were provided; these processes were not sustainable. **Staff 2:** "...the first step was to call the people and make an appointment and we were spending so much time not being able to reach somebody that we decided to see, well, what happens if we just mail everything out and then, you know, ask them to call back to confirm."

In fact, with the passage of time, the resources invested in scheduling pre-screen appointments had incrementally decreased. During this study, patients were not asked to confirm their appointments as the CCSC found it difficult to handle the incoming calls. During this study patients were to call only if they could NOT make the appointment, otherwise, the CCSC would operate on the assumption that the patient would attend.

The process for managing incomplete pre-screen appointments evolved during this study. Early in the fall of 2010, clerks were tasked with contacting non-attending patients by phone to either rebook or cancel the pre-screen appointment based on the conversation with the patient. However, staff members were largely unable to manage this and the list of non-attendees grew larger each week. During November and December, the clinic did not make contact with non attending patients.

Early in the 2011, the clinic began to generate a list of non-attendees which was used to fax the referring physician informing them that their patient did not attend. The fax advised that the referral would be cancelled if the patient did not reschedule within 30 days. This removed the responsibility and complexity of rebooking patients from the CCSC and placed it with the family physician. The impact of this process on appointment completion and overall patient care was not assessed in this study.

Operational data was used to examine the relationship between key variables (i.e. triage level, research participation, sex, residency, wait time, age) and appointment completion. Approximately 6200 pre-screen appointments were scheduled between January and June 2010. The portion of incomplete appointments for various categories was tabulated.

Overall, 21% of appointments were incomplete with most variables clustered between 17-24%. Research patients had the lowest likelihood of incomplete appointments (4.5%). Figure 4 summarizes these categories.

**Figure 3. CCSC Pre-Screen Booking Process Map.** While all components were described in organizational documents, only bolded boxes were observed in practice.

**Figure 4. Incomplete Pre-Screen Appointments By Patient Category**

Consistent with prior research, the likelihood of an incomplete appointment increased as wait times grew as shown in Figure 5.

**Figure 5. Incomplete Pre-Screen Appointments and Wait Times**

Incomplete appointments among "urgent priority" patients were 22%, while urgent and moderate risk patients were 21.0% and 22.3% respectively. Routine patients, those with no increased risk factors for CRC, had the smallest portion of incomplete appointments (17.5%). This finding is...
inconsistent with prior research [16, 17] which found higher risk patients more likely to attend colonoscopy. The reasons for higher rates of incomplete appointments among high risk CCSC patients are discussed section 4.1.

Operational data was used to conduct a longitudinal analysis of incomplete appointment rates over three years (January 2008 to December 2010). Over 26,000 pre-screen appointments were scheduled during this time and the portion of incomplete appointments was calculated based on six-month intervals (Figure 6).

![Figure 6. Incomplete Pre-Screen Appointments Across Time](image)

Scheduled pre-screen appointment volumes ramped up quickly, nearly doubling during the first year of operations. In 2008, about 1500 pre-screens were scheduled in the first six months increasing to almost 3000 for the remainder of the year. In 2009, approximately 5000 pre-screen appointments were booked in each six-month period rising to 6000 the following year. While the volume of pre-screen appointments booked grew, the portion of incomplete appointments has grown more quickly.

4.0 Findings – Reasons for Incomplete Appointment Patterns

Staff suggested the current booking processes contributed to incomplete appointments. Staff reported that letters were commonly sent to inaccurate addresses.

**Staff 6:** “I think one of the problems is, is, again, it's the mail outs. It's a good idea because you... they can do massive amounts... but, in saying that, some, because these referrals are old, so 2007/2008, some people have moved since then or changed address or whatever, so all the sudden these mail outs, people aren't getting.”

Staff also recognized that the notification letter did not allow patient choice in scheduling their appointments and recognized this as another weakness of the notification letter:

**Staff 1:** “…we mail it out, so the patients don't get an option of when they actually come unless they call us back to say that they need to change it…”

Lengthy waiting times were another complication identified:

**Staff 2** “…could have been a 2-year referral for an average risk person, or you know, where that person has forgotten all about it, you know, so as time goes... maybe they did have a conversation with their family doctor 2 years ago, but now they don't remember that. So I think that, you know, I'm not surprised that there is a no-show rate for prescreens.”

Finally, staff members reported that patients were often unaware a referral for screening had been made. As a result, they were not expecting an appointment and so communicating with them to schedule an appointment was likely to be met with confusion. Staff recognized the impact of referral awareness on completion of the pre-screen appointments:

**Staff 2** “”I continue to be amazed at how many people get a referral and they don’t actually know that they had a referral”

Patient interviews confirmed that the notification letter was ineffective. Four (Patients 2, 3, 5 and 7) did not receive the appointment scheduling letter, although it had been mailed to the correct address. Another (Patient 1) received the letter but did not understand that it was for accessing colonoscopy.

Logistic issues such as work and personal responsibilities were other barriers to appointment completion:

**Patient 7:** “I have only about 8 days a month that I'm in town - 8 working days. So somewhere it would have to land in those. Or I would have to make a special trip”.

Family circumstances also influenced patient attendance – in some cases, family circumstance was a barrier while in others it was supportive:

**Patient 3:** “I'm single so I'd have to find somebody, I guess, to drive me. That's the, and you have to find someone to pick you up, is that correct?”

**Patient 2:** “I have my two grandchildren living with me...my husband can look after them while I'm getting this done.”

A second round of patient interviews included two urgent priority patients, two patients that did complete the pre-screen appointment and one urgent patient. The three non attendees (patients 8, 10, 12)
were all aware of the appointment but had logistics difficulties including contacting the clinic to cancel or change the appointment:

**Patient 12** “I'm not a driver - I live out of town - I don’t drive, so I needed to rely on another person for transportation and their work schedule got changed. ...I just got the answering machine. “

**Patient 8** “...at 8 o'clock in the evening I put a thing on her recorder... told her to cancel my appointment for now.”

Some patients found the automated phone system (which was implemented during the course of this study) frustrating and inadequate.

While logistic issues were the prevailing barrier among patients scheduled by notification letter, cognitive/emotional issues were more common among urgent priority patients. One urgent priority participant admitted anxiety about the appointment given the serious impact colon cancer had had on her family:

**Patient 12:** “...psychological, emotional, it was, because I know with the family history...unfortunately, and the result with my mum was she was diagnosed at the age of 42 and died at 46.”

Interviewer: “So a bit of anxiety about it?”

**Patient 12:** “Exactly. I probably should have had this done a couple of years ago but I didn’t.”

The second urgent priority patient did not openly admit to anxiety, but was insistent and quite aggressive in claiming that he had cancelled the appointment and did not want to reschedule the appointment. He offered a number of barriers:

**Patient 8:** “Well, like I told you, it takes me #4, #19, #119 and then I have to go up to the University. They take me to the University and I have to get the 20 and the wind chill was -40 that day and I wasn’t coming out in that weather... when we bought this dog out in Taber we signed an agreement that he is never to be left alone. Never to be left alone this little daxie...And the house, cause we've got so many break-ins around here.”

Both staff and patients described technological innovations that could improve appointment completion either directly, such as using web-based self scheduling, and automated reminder calls; or indirectly by helping improve efficiency such as implementing a phone tree to route calls, using mail merge to generate letters and using write-fax to follow up with missed appointments.

The CCSC was aware that a notification letter was a substandard booking strategy, however, telephone contact was too resource intensive. Staff were surprised that Urgent Priority patients had similar rates of incomplete appointments, in spite of the fact that they were contacted by phone to arrange the appointment.

We have amalgamated and summarized the findings in Table 2 according to the triage level, percentage or incomplete appointments, and the primary barriers in play for each group. We discuss these findings and the IT implications in the next section.

<table>
<thead>
<tr>
<th>Triage Level</th>
<th>% Incomplete</th>
<th>Primary Barriers</th>
<th>Proposed IT Enabled Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgent Priority (UP)</td>
<td>22.0</td>
<td>Cognitive-Emotional</td>
<td>Connect with online support community.</td>
</tr>
<tr>
<td>Urgent (U)</td>
<td>21.0</td>
<td>Cognitive-Emotional Health System</td>
<td>Connect with online support community.</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>22.3</td>
<td>Health System Logistical</td>
<td>Connect with online support community. Online concierge.</td>
</tr>
<tr>
<td>Routine (R)</td>
<td>22.2</td>
<td>Health System Logistics</td>
<td>Online concierge. Online scheduling.</td>
</tr>
<tr>
<td>Routine Research (RR)</td>
<td>4.5</td>
<td>Not Applicable</td>
<td>Online collaboration. Online concierge. Online scheduling.</td>
</tr>
</tbody>
</table>

Table 2. Barriers & Mechanism by Category

5. Discussion

Although the CCSC has a focused mandate it still represents an extremely complex organizational context since all the components of the larger health care system are still represented in this smaller setting. Through this study a number of incremental improvements have been identified and implemented but the current operations are unsustainable in the context of the larger health care system. It is too expensive to have such broad screening for all triage categories. More personalized methods are needed so that the criteria for screening are more granular and tailored to the specifics of the individual. The broad selection criteria of over 50 simply produces an over demand that skews any reasonable attempts to provide service to those that really could benefit from screening. While these health system changes to clinical care are beyond the scope of the current study, the necessity to move towards more personal, yet cost effective, delivery of care was taken as a guiding principle for the implementation of any future IT investments.

Thus while a number of incremental changes could be reasonably implemented to better leverage existing technologies and tweak existing processes,
for the next phase of this work it was felt that more disruptive innovation was needed if significant improvements were to be made. This essentially means moving away from the practices that have characterized the larger healthcare system (and those forces constraining many of these changes) and adopting practices and technologies that represent a radical departure from the status quo.

In this regard we are currently taking the findings from this case study and translating the personalized medicine approach for implementation in technology. That is, while providing personalized services (e.g., personal phone reminders, concierge service etc.), proved successful in reducing missed appointments these practices are financially and resource intensive and were only possible for short periods of time or in the context of individual research studies. Once these studies are completed, ongoing operations are unable to sustain the ongoing commitment of people and time needed to materially impact rates of completed appointments, or other areas in need of improvement.

A more radical approach, and one that has proven both cost and practice-effective in other industries, is the use of self-serve technologies that push many of the operational responsibilities to the patient/client. This provides increased autonomy and empowerment while also facilitating a channel of communication that can be personalized in a semi-automated manner. This approach represents a significant departure from current practice both in how things are currently done and in the technologies used to get things done. In this regard we are looking towards an emerging class of technologies broadly referred to as Personal Health Record (PHR) systems (that were recently adopted in Alberta but not fully implemented). We have proposed to implement a range of mechanisms that balance the costs of providing these personalized services in a technology-mediated manner. Through this self-serve collaborative environment the CCSC is able to have an ongoing conversation with their clients that addresses the various barriers identified for each triage category while leveraging the mechanisms that have been shown to address those forces impeding change, and in an integrated and cost effective manner.

The proposed IT enabled mechanisms (See Figure 2) are design criteria upon which the system is being established. This design recognizes that each triage category of patient has a varying portfolio of barriers to accessing healthcare services and that the self-serve technology will facilitate self-selection by the patient for the functionality that they require.

For Urgent Priority patients the largest barrier is the cognitive-emotional stress related to their increased risk of colon cancer; often they have a relative that has died from the disease. Understandably this group approaches the screening procedure with trepidation and fear. This group would be directed towards an online support community of similar patients so that personal experiences related to their own screening and family history can be related in a manner whereby the CCSC brokers this relationship with other patients but does not have to maintain staff resources to provide this counseling role. The PHR would serve as the portal entry point through which patients would be connected to this community.

Similar cognitive-emotional stresses arise with the Urgent group (although not as acute) so they will also be directed towards the online support community. In addition, this group tends to have further challenges related to communications with their primary care physician whereby they often do not know that they even have an appointment. This necessitates more direct communications between the CCSC and the patient as facilitated through the PHR portal that would include closing the loop with the primary care physician without having to rely on innumerable faxes that the patient is not even privy to. Again, more of the responsibility for the patient’s care is placed with the patient.

The Moderate group have similar system level concerns so would also use the PHR portal for direct communications but this group also have further issues around convenience of (re)scheduling appointments and other logistical challenges that tend to easily preclude them from attending their appointments. Thus this group would be directed towards a combination of online training, scheduling and concierge services, again presented as modules through the integrated PHR environment.

It is not really clear how the health care system should optimally deal with the Routine group or even if they should be scheduled for screening at all. This broader health system issue notwithstanding, this group tends to have the same logistical issues that the Moderate group experiences and would therefore be directed towards the training, scheduling and concierge services within the PHR portal as well.

Within the Routine group is a subgroup of patients that participate in ongoing research studies sponsored by the CCSC. There are no real barriers for this group since they already receive the personalized services envisioned and have very low incomplete appointment rates. The challenge for this group is scaling the research to include more patients and the limited research funding available to support their current premium service levels. Thus we anticipate eventually directing this group to more cost effective online training, scheduling and concierge
services as well. In addition, there is an ongoing collaboration between the researchers and research participant patients that extends well beyond that with a regular patient of the CCSC. Therefore we would also envision providing an online forum for this conversation to continue and grow between the researchers and patients that would be further integrated with the data collection processes and the integration services of the PHR.

In the next section we present limitations of this study and place this work in the context of future research.

6. Conclusion

This study is based upon and thus the generalizability of the findings should be viewed in that context. This limitation notwithstanding, there are considerable contributions possible through generalizations back to theory. In this regard many of the patterns and mechanism identified in this single context can be applied more broadly for other screening programs and beyond. In this regard the ontology guiding this mini-track provides an extremely useful framework in which to continue these discussions. The contributions of this work are best appreciated in the context of the ontology guiding the mini-track. Specifically, this work highlights the need to fully investigate the interplay between the people and process that emerge in practice around administrative collaborations that can serve to both enhance or impede IT based interventions targeted at improving efficiency within health care. While significant effort is directed towards research and initiatives focused on improving the collaborations needed for the direct care of patients, there is considerably less attention given to those activities which serve to indirectly impact patient care. We have highlighted that one potential bottleneck in such collaborations are the incomplete appointments that result from the interaction of a myriad of factors that we identify for various patient types. For each patient type we observe a different profile of factors implicated in incomplete appointments. We argue that our research site represents a strong collaborative context, and that our findings and recommendations are focused on providing evidenced based direction for future IT interventions, some of which we are currently implementing as part of a larger action research initiative. Future work will focus on the potential disruptive impacts of those innovations.

7. References


keeping behavior. *Annals of Internal Medicine, 140*(7), 528-532.


